Roll No. .....

3027

B. Tech 3rd Semester (Civil Engg.) Examination – February, 2022

ENGINEERING MECHANICS

Paper : PCC-CE-203G

Time : Three hours] *[Maximum Marks : 75*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Question No. **1** is ***compulsory***. Each question carries equal mark. Students have to attempt *five* questions in all *one* question from each Section. Assume suitable data.

1. (i) Deduce the relation between shear force and bending moment.

(ii) Describe the method of tension coefficients for the analysis of plane trusses.

(iii) Write about Mohr's theorems.

(iv) A steel bar of 200 mm long is placed between two supports with an end clearance of 0.3 mm. Its temperature is then raised by 200°C. What will be the stress in the bar ? For steel Es = 200 GN/m^2 and $\alpha_s = -12 \times 10^{-6}$ per °C.

(v) Find the maximum torque transmitted by a hollow circular shaft of external diameter 30 cm and internal diameter 15 cm, if the shear stress is not to exceed 40 N/mm^2.

(vi) What are the criteria for stability of columns ?

$6 \times 2.5 = 15$

SECTION – A

2. (a) Deduce the relation between the Modulus of Elasticity and Modulus of Rigidity from fundamentals. 5

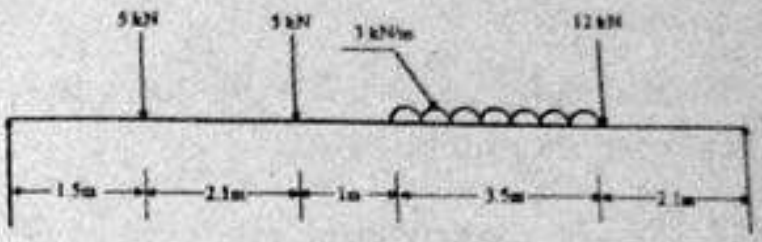
(b) A bar of length 3 m has a diameter of 50 mm over half its length and a diameter of 25 mm over the other half. If $E = 2.06 \times 10^5$ N/mm^2 and the bar is subjected to a pull of 50 kN. Find the stress in each section and total extension of the bar. 10

3. (a) The principal stresses at a point subjected to two dimensional stresses are $66N/mm^2$ and 50 N/mm^2 compressive. Find the plane on which the resultant stresses has maximum obliquity and magnitude of the obliquity. Find also the resultant stress. 7.5

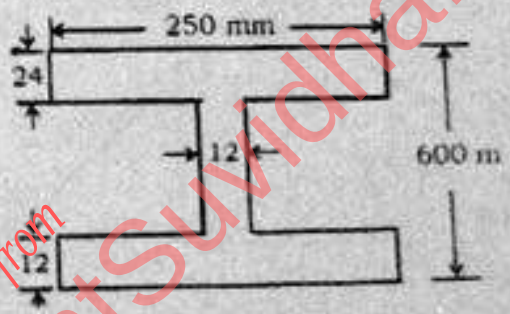
(b) Calculate the proof resilience and modulus of resilience due to extension of steel bar 20 mm diameter and 1500 mm length. The stress induced in elastic limit and modulus of elasticity for steel bar is 250 N/m^2 and 200 GN/m^2 respectively. 7.5

SECTION – B

4. Draw SF and BM diagrams for the beam loaded as shown in figure below. All loads are in kN and length are in meter : 15



5. A beam of I-section as shown in figure below. The beam is simply supported over span of 10 m and carriers a u.d.l. of 50 kN/m km run over the entire span. Calculate the maximum stress produced due to bending. 15



SECTION – C

6. A solid steel shaft 100 mm diameter 95 kW at 200 r.p.m., calculate : 15

(a) torque on shaft;

(b) the maximum shear stress induced;

(c) the angle of twist in a length of 800 mm;

(d) the shear stress at a radius of 45 mm;

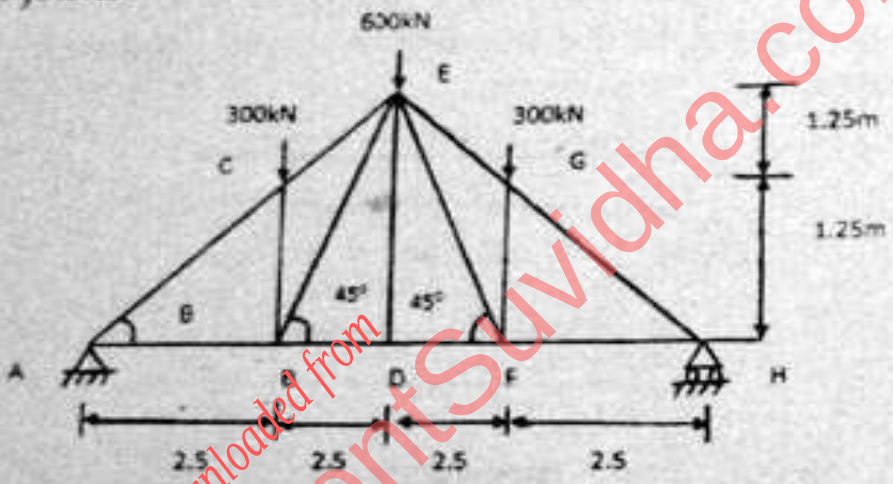
Take $G = 0 \times 8' 10^5 N/mm^2$

7. (a) Compare the ratio of the strength of a solid steel column to that of a hollow of the same cross sectional area. The internal diameter of the hollow column is 3/4 of the external diameter. Both the columns have the same length and are fixed at the ends. 10

(b) What is Euler's theory ? Write down the limitation of Euler's Formula. 5

SECTION – D

8. Analyze the pin jointed truss as shown by the method of joints. 15



9. Explain the following : 15

(a) Maximum principal stress theory

(b) Distortion energy theory